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Natural Resource Stewardship and Science

Prairie and Peregrine Falcon Occupancy and Productivity Monitoring at Pinnacles National Park

2014 Annual Report

Natural Resource Technical Report NPS/SFAN/NRTR—2014/926

ON THE COVER
Prairie falcon fledgling, Discovery Wall, Pinnacles National Park, California.
Photograph by: Gavin Emmons, San Francisco Bay Area Network Inventory and Monitoring Program.

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Executive Summary

Pinnacles National Park ("Pinnacles") provides a diverse habitat for numerous cliff-nesting raptors, including prairie falcons (*Falco mexicanus*) and peregrine falcons (*F. peregrinus*), as well as a spectacular array of summits and cliff-wall routes for rock-climbers. This monitoring program was established to determine long-term trends in the number of occupied territories and productivity of nesting prairie and peregrine falcons. Ancillary data on presence and diversity of other nesting raptors are documented for this season in the Breeding Raptor Distribution and Nesting Phenology at Pinnacles National Park: 2012–2014 Report (Emmons in review). The monitoring program grew out of a need to reduce potential disturbance that climbers and off-trail hikers may have on cliff-nesting raptors. This report summarizes the results from the 2014 breeding season and represents the 29th year of monitoring at the park, consistent with the standardized methods and procedures detailed in the Prairie Falcon Monitoring Protocol for Pinnacles National Monument (Emmons et al. 2011).

To monitor falcons, field technicians surveyed all potential nest sites three times per breeding season, with visits spaced 21–28 days apart. Nests determined to be active were revisited to confirm rearing of nestlings and fledging of young. In 2014, monitoring was conducted from 1 January 2014 until 1 August 2014, with a total of over 150 possible and active nest sites monitored during 678 observation hours.

Twelve territorial falcon pairs were documented this year with 10 pairs actively nesting. Seven nests successfully fledged 27 young; three nests failed.

Acknowledgments

This program would not be as successful as it is without the eyes and ears of helpful Pinnacles employees. Therefore, I would like to thank the National Park Service employees for their help, encouragement, and passion for the raptors and wildlife diversity at Pinnacles. The many local climbers involved with Friends of Pinnacles also deserve my thanks for their ongoing support of resource protection and breeding raptors at the park and particularly their efforts to publicize and honor advisories in effect. I would also like to extend my appreciation to the park visitors, for their reports and observations on raptor sightings and for their appreciation and value of the importance of monitoring, managing, and protecting the nesting sites and breeding productivity of raptors in the park.

I would like to thank B. Johnson, P. Johnson, P. Urbach, J. Belli, R. Neidhardt, S. Scherbinski, J. Jones, A. Punzalan, R. Fielding, D. Powell, L. Regan, D. Ryan, and A. Welch for contributing valuable observations on raptor territories and pair behavior in the park. I greatly appreciated efforts by A. Schmidt for her excellent monitoring efforts this season, and for the invaluable support that A. Sartain, M. Gnekow, and K. Iverson provided as raptor monitoring volunteers in 2014. I am also grateful for D. Louie's and P. Johnson's support and efforts, in tandem with D. George as the manager of the Inventory and Monitoring (I&M) Program, to keep the Pinnacles raptor monitoring program funded annually and on a permanent basis. S. Wakamiya also provided valuable assistance in her role as the I&M Program Data Manager revising the design and enhancing the functionality of the raptor monitoring database. D. Adams, D. George, P. Johnson, and A. Welch also provided recommendations and reviewer suggestions for the 2014 annual report, contributing greatly to a concise and efficient document consistent with I&M standards.

The following staff also shared their experience, excitement, and observations of raptors with me throughout the season, granting me a more complete picture of raptor breeding and diversity at the park, and assisted in the effective management of raptor advisory areas: G. Gigliotti, M. Spero, K. McCrary, and G. Paulsen.

Introduction

Pinnacles National Park ("Pinnacles") is a National Park Service (NPS) unit located in the Gabilan Mountains of central California, and was legislatively converted from a national monument to a national park in January 2013. Pinnacles provides a diverse habitat for cliff-nesting raptor species, including sensitive species such as prairie falcons (*Falco mexicanus*), peregrine falcons (*F. peregrinus*), and golden eagles (*Aquila chrysaetos*). The dramatic landscapes, extensive trails, arrays of summits, and cliff-wall routes at Pinnacles are also used intensively for recreation by rock-climbers and hikers. Because prairie falcons nest in the Pinnacles cliffs and in sufficient density to track trends in reproduction over time, this species is the central focus of the monitoring program. Additionally, peregrine falcons are documented in this report because they occupy the same nest habitat and are direct competitors to prairie falcons. Other raptor species in the park either nest in forested habitats or do not nest in sufficient densities within the park to warrant a similar level of monitoring effort.

Many scientific studies have documented the negative impacts of human disturbance of raptor nest and roost sites, and the resulting nest failures and territorial abandonment associated with these disturbances. Nesting raptor species at Pinnacles sensitive to human disturbance include prairie falcons (Fyfe and Olendorff 1976, Ogden and Hornocker 1977, Harmata et al. 1978, Sitter 1983, Steenhof 1998), peregrine falcons (particularly in remote locations: see Hickey 1942, 1969, Bond 1946, Steenhof 1998), golden eagles (Newton 1979, 1990, Scott 1985, Steidl et al. 1993, Watson 1997, Steenhof et al. 1997, Kochert et al. 1999), sharp-shinned hawks (*Accipiter striatus*; Delannoy and Cruz 1988), and long-eared owls (*Asio otus*; Marks 1986, Marti and Marks 1989, Bloom 1994).

Studies of prairie and peregrine falcon nest occupancy and productivity have also shown the species to be especially sensitive to human disturbance from mining (Becker and Ball 1981, Bednarz 1984), recreation (Boyce 1982), agriculture (USDI 1979), habitat destruction and nest site limitation (Becker and Ball 1981, Steenhof et al. 1997), and proximity to major roadways (Platt 1974, Boyce 1982).

The main sources of human disturbance of nesting falcons at Pinnacles are visitors who are rock-climbing and hiking on- and off-trail in the park. Scientific studies have consistently suggested that these recreational activities can be balanced against raptor nesting by establishing closure or advisory areas that act as buffers between human activity and raptor nesting during the breeding season (Fyfe et al. 1976, Olsen and Olsen 1978, Becker and Ball 1981, Suter and Joness 1981, Porter et al. 1987, Holthuijzen et al. 1990, Cade et al. 1996, White et al. 2002). Raptor monitoring program survey data collected at Pinnacles justify the establishment of climbing/hiking advisories in core areas (high visitor-use areas) each breeding season as a way to protect cliff-nesting raptor species from human disturbance.

The Prairie Falcon Monitoring Protocol for Pinnacles National Monument (Emmons et al. 2011) provides standardized methods and procedures for prairie and peregrine falcon monitoring at Pinnacles and further details the program specifics. The program established two long-term monitoring objectives to:

- Track changes in the total numbers of territorial falcon pairs in core areas and non-core areas.
- Track changes in average annual productivity (young of year hatched/pair, young of year at banding age/pair, young of year fledged/pair) in core areas and non-core areas.

Core areas are locations at Pinnacles suitable for prairie and peregrine falcon cliff-nesting where climbing impacts could occur, based on the presence of historic climbing routes accessible to visitors. Non-core areas refer to all other areas within Pinnacles suitable for cliff-nesting. The core vs. non-core sampling design is detailed further in the Methods section.

A secondary benefit of the monitoring program is that a substantial amount of information can also be gathered on other raptor species at Pinnacles, particularly sensitive California species that may be impacted by human presence and disturbance in riparian habitats such as: golden eagles, Cooper's hawks (*Ac. cooperii*), sharp-shinned hawks, white-tailed kites (*Elanus leucurus*) , and long-eared owls. Breeding data collected on other raptor species during the 2014 season will be documented in the Breeding Raptor Distribution and Nesting Phenology at Pinnacles National Park, 2012–2014 Report (Emmons in review).

Study Area and Field Methods

Pinnacles is located in the Gabilan Mountains of the central Coast Range of California. The national park encompasses 10,694 hectares (26,425 acres) with elevation ranging from 244 to 1,007 meters (800 to 3,304 feet). The climate is Mediterranean with hot, dry summers and cool, damp winters. Temperatures range from a mean of 5.2˚C in December to 25.2˚C in August (41.4˚ to 77.4˚F). The average yearly rainfall is 42.3 cm (16.6 inches), with the majority of rainfall occurring from November to April (WRCC 2013).

Pinnacles provides a diverse range of habitat types for birds and other species. These habitats include volcanic rock formations and outcroppings, California mixed chaparral, pine-oak woodlands, grasslands, and riparian creek corridors.

Sample Design

The prairie and peregrine falcon monitoring is focused on core areas and non-core areas. Each core and non-core area is a potential nesting territory, and in this context the terms “area” and “territory” can be used interchangeably. Within a given year, prairie or peregrine falcons may actively defend one or more of these areas or territories. Core areas (Figure 1) are locations in Pinnacles that can support falcon cliff nesting, and where impacts to raptors due to rock climbing activities can occur based on historic rock-climbing use and access. Core area monitoring surveys are conducted through a census, because the area is sufficiently small to allow for complete coverage.

Non-core areas refer to all other areas within the park that can support prairie and peregrine falcon cliff nesting. The Prairie Falcon Monitoring Protocol for Pinnacles National Monument (Emmons et al. 2011) calls for sampling non-core areas on a rotating basis. For 2003–2014, non-core area sampling has been conducted through a census along with core area censuses. This park-wide censusing of core and non-core areas has been possible because of comprehensive historical data on prairie and peregrine falcon nest sites gathered over the past 29 years, extensive monitoring experience of the raptor biologist, and supplemental raptor monitoring efforts by interns, volunteers, and other Pinnacles employees. In addition, GIS modeling completed in 2008 confirmed that all potential prairie and peregrine falcon nesting areas in the park have been surveyed annually during the past 12 years.

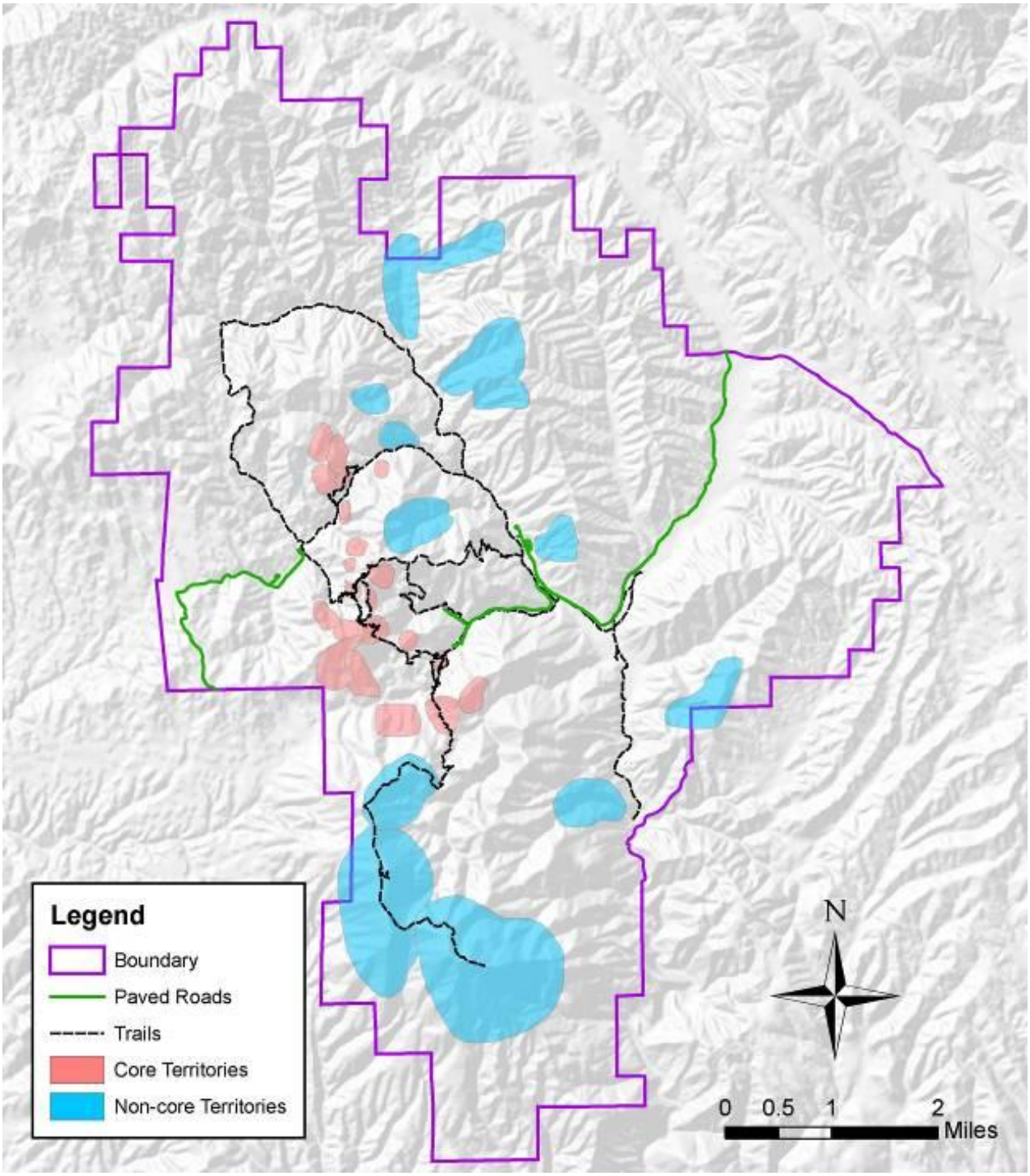

Figure 1. Core and non-core areas at Pinnacles National Park.

Field Methods

Survey methods followed the standard operating procedures detailed in the Prairie Falcon Monitoring Protocol for Pinnacles National Monument (Emmons et al. 2011).

Potential and established prairie and peregrine falcon territories in core and non-core areas were surveyed using Swarovski HD STS-80 and ATS-65 20–60x spotting scopes and Zeiss Victory FL 10×42 binoculars. Observations were made from the locations that provided the best view of an eyrie or a territory. Magellan Triton 500 and DeLorme Earthmate PN-60 GPS units were used to plot every observation point. Field data were documented with standardized datasheets and field notebooks and the data were entered into a Microsoft Access database (Appendix D).

Three- to five-hour observation periods are commonly recommended to document territorial occupancy of peregrine falcons and prairie falcons (USFWS 1984, Cade et al. 1996, Smith and Hutchins 2006). Steenhof et al. (1999) employed two-hour observation periods during point surveys to document territory occupancy of prairie and peregrine falcons in the Snake River region of Idaho. For a potential falcon territory to be classified as unoccupied at Pinnacles, we adopted a conservative standard of visiting potential nest sites at least three times per breeding season spaced 21–28 days apart to confirm territorial occupancy, courtship, and incubation of eggs within a breeding season (Fuller and Mosher 1981, Fraser et al. 1983, Steenhof 1998). Survey duration was ultimately dependent upon visibility, but at least three 4-hour surveys (12 hours total) were required to verify that "no birds" were present. Nests determined to be active were revisited to confirm rearing of nestlings and fledging of young. Nests in core areas were monitored more frequently and during weekend days when climbers were more likely to be present.

While other monitoring programs infer fledging success at 90% fledge age (Steenhof and Kochert 1982, Anderson and Squires 1997, Steenhof 1998), our protocol continues surveys until all young falcons are confirmed as fledged.

During the falcon breeding season status was asserted as follows:

Territories: Territorial behavior included perching, flying, territorial disputes and defense, stooping and scold calling, and roosting locations.

Courtship: Courtship behavior included copulation, food drops and swapping, and potential nest site inspections and preparation.

Incubation: Incubation status was determined by observing prairie falcons flying into a nest hole and not re-emerging for extended periods of time. During this time, egg counts were made whenever possible (e.g., when lighting conditions allowed and when incubating falcons temporarily left the nest during food drops and/or nest switches). Soft incubation – the onset of incubation – was determined by a small number of eggs laid and the female incubating for short durations (15–75 minutes of incubation and 20 minutes or more not incubating the eggs). Hard incubation was characterized by the adult falcons – primarily the females – incubating a full clutch of eggs for hours in duration.

Nestlings: Hatched young prairie and peregrine falcons were aged by physical features using an aging guide (Moritsch 1983). Hatch dates were determined by counting backwards from at least two (preferably three or more) independent aging estimates.

Fledging: Fledging was confirmed by seeing young perched and/or in flight away from the nest site. Fledging dates were estimated by the coordination and strength of flight, the size of perches, and the amount of vocalization during flight.

Monitoring Schedule

The prairie and peregrine falcon monitoring season started on 1 January and continued through the end of the nesting season, 1 August (Table 1).

Table 1. Timing of nesting behavior of prairie falcons at Pinnacles National Park.

Behavior	January	February	March	April	May	June	July
Territorial Falcons							
Courtship Behavior							
Nesting							
Fledging							

Weather was always an important factor. During temperature extremes, heavy fog, or rain, most birds of prey are generally inactive and therefore monitoring was not done during these periods.

Data Management

Data are entered into a Microsoft (MS) Access database designed by the network data manager for the San Francisco Bay Area Network Inventory and Monitoring Program. Original data sheets are archived with Pinnacles Resource Management. An annual (static) copy of the Access database is archived on the Golden Gate National Recreation Area computer network drive. Nest data are also submitted to the California Department of Fish and Wildlife (previously California Department of Fish and Game) California National Diversity Database and the Santa Cruz Predatory Bird Research Group.

Figure 2. Setting up advisory sign. Photo by Gavin Emmons, 2014.

Tabular data in the Results section of this report are derived from queries to the Breeding Raptors and Raptor Observations tables in the MS Access database.

Climbing Advisories

Climbing advisories went into effect by mid-January. Informational signs were established near territories occupied by prairie and peregrine falcons at least once during the preceding three years. Visitors were advised to avoid these areas but compliance was voluntary. Advisory areas with posted signs (Figure 2) included the Balconies, Hawkins, Scout Peak, and Little Pinnacles territories.

Results

During the 2014 field season, Pinnacles staff spent 600 hours in the field surveying for prairie and peregrine falcons and volunteers contributed 78 hours of time. Results for prairie falcon monitoring in core and non-core areas are detailed below. Results for peregrine falcon monitoring – and tabular data for combined prairie and peregrine falcon productivity – are detailed in Appendix B. Currently, the monitoring protocol (Emmons et al. 2011) focuses specifically on monitoring prairie falcons as a target species. However, both prairie and peregrine falcons have nested at Pinnacles historically, are sensitive to human disturbance, are obligate cliff-nesters, and have identical nest phenology patterns. Results for peregrine falcon monitoring are included in Appendix B with the expectation that the monitoring protocol (Emmons et al. 2011) will be updated to focus on both prairie and peregrine falcon monitoring in the future.

Prairie Falcons

Ten prairie falcon pairs attempted to nest this year and 7 successful nests produced 30 nestlings and 27 fledglings (Figure 3), compared to 28-year averages of 10.0 nesting pairs, 7.9 successful nests, 29.1 nestlings, and 27.3 fledglings (Table 2).

Occupied Territories

Through the 2014 season, 12 territorial pairs of prairie falcons were confirmed over the course of the breeding season. This number is comparable to the average territorial occupancy of 11.9 pairs from 1984–2013 (Table 2). Of these, two pairs did not nest or produce young this year.

Core Areas: In 2014, there were 6 territorial prairie falcon pairs within the core areas. The average number of territorial falcon pairs in the core areas over the previous 28 years was 7.3.

Non-Core Areas: In 2014 there were 6 territorial prairie falcon pairs within the non-core areas. The average number of territorial falcon pairs in the non-core areas over the last 28 years was 4.6.

Figure 3. Prairie falcon fledgling at South Balconies. Photo by Gavin Emmons, 2009.

Table 2. 1984–2014 Pinnacles prairie falcon nesting productivity – core and non-core areas combined.

Year	Territorial Pairs	Nesting Pairs	Successful Nests	# Nestlings	# Nestlings / Nest	# Fledglings	# Fledglings / Nest
1984	**10**	**9**	**8**	**30**	**3.8**	**27**	**3.4**
1987	**6**	**4**	**4**	**13**	**3.3**	**10**	**2.5**
1988	**12**	**9**	**8**	**24**	**3.0**	**24**	**3.0**
1989	**12**	**12**	**9**	**24**	**2.7**	**21**	**2.3**
1990	**14**	**10**	**8**	**31**	**3.9**	**29**	**3.6**
1991	**14**	**11**	**10**	**34**	**3.4**	**34**	**3.4**
1992	**13**	**11**	**10**	**38**	**3.8**	**34**	**3.4**
1993	**13**	**12**	**10**	**39**	**3.9**	**35**	**3.5**
1994	**13**	**13**	**12**	**45**	**3.8**	**42**	**3.5**
1995	**13**	**11**	**8**	**24**	**3.0**	**24**	**3.0**
1996	**12**	**10**	**9**	**35**	**3. 9**	**34**	**3.8**
1997	**12**	**8**	**6**	**26**	**4.3**	**26**	**4.3**
1998	**10**	**7**	**0**	**0**	**0**	**0**	**0**
1999	**10**	**8**	**6**	**25**	**4.2**	**25**	**4.2**
2000	**8**	**8**	**7**	**22**	**3.1**	**22**	**3.1**
2001	**10**	**10**	**7**	**24**	**3.4**	**24**	**3.4**
2002	**11**	**9**	**7**	**26**	**3.7**	**22**	**3.1**
2003	**12**	**9**	**8**	**33**	**4.1**	**32**	**4.0**
2004	**12**	**11**	**9**	**36**	**4.0**	**33**	**3.7**
2005	**13**	**10**	**9**	**29**	**3.2**	**24**	**2.7**
2006	**15**	**14**	**10**	**35**	**3.5**	**30**	**3.0**
2007	**14**	**12**	**9**	**35**	**3.9**	**33**	**3.7**
2008	**12**	**5**	**4**	**12**	**3.0**	**12**	**3.0**
2009	**12**	**11**	**10**	**41**	**4.1**	**37**	**3.7**
2010	**13**	**11**	**7**	**27**	**3.9**	**27**	**3.9**
2011	**13**	**12**	**8**	**33**	**4.1**	**33**	**4.1**
2012	**12**	**11**	**8**	**28**	**3.5**	**27**	**3.4**
2013	**12**	**11**	**10**	**47**	**4.7**	**43**	**4.3**
2014	**12**	**10**	**7**	**30**	**4.3**	**27**	**3.9**
Averages (1984–2013)	**11.9**	**10.0**	**7.9**	**29.1**	**3.5**	**27.3**	**3.3**

Annual Productivity

Ten of the 12 prairie falcon pairs nested. For the 10 nesting pairs, seven successful nesting attempts fledged a total of 27 young (Tables 2, 3). Three nests failed during the 2014 season, with two nests failing during egg incubation and one nest failing after 3 nestlings hatched. Three nest failures were documented at during the 2014 season, one during incubation, one likely just after hatching of young (given observations of attempted prey deliveries after nest failure), and one during development of nestlings. Given remoteness of the nest sites, moderate temperatures during the periods of nest failure, and suspected or confirmed nestlings at North Chalone Peak and NE Section 15, predation was suspected for all nest failures. However, given the lack of confirmed observations (e.g. of predated eggs or nestlings) and constant monitoring at the sites (e.g., through remote video surveillance), other causes of nest failure cannot be entirely ruled out.

Total nesting falcon pairs and successful nests within core and non-core areas this season were comparable with the 28-year averages. Productivity of nestlings and fledglings (in total and per nest) were comparable with the 28-year averages (Table 2, Figure 4).

Table 3. 2014 Pinnacles prairie falcon breeding summary.

Territory	Nest Used/ Last Year Used	# Eggs Laid	# Young Hatched	# Young Known/ Fledged
Crowley Towers*	CT-1/2011		5	5/5
Drywall	DRY-15/NEW	4	4	4/4
Egg*	EGG-1/2014	5	5	5/5
NE Section 15	NE-4/NEW			0/0
North Chalone	NC-1/2014	3	3	0/0
Pig Canyon	PIG-11/NEW			0/0
Resurrection Wall*	RW-2/2013	4	2	2/2
South Balconies*	SGB-15/2010		4	4/4
Willow Spring Slide	WSS-2/2014	4	4	4/4

*nests within the core area.

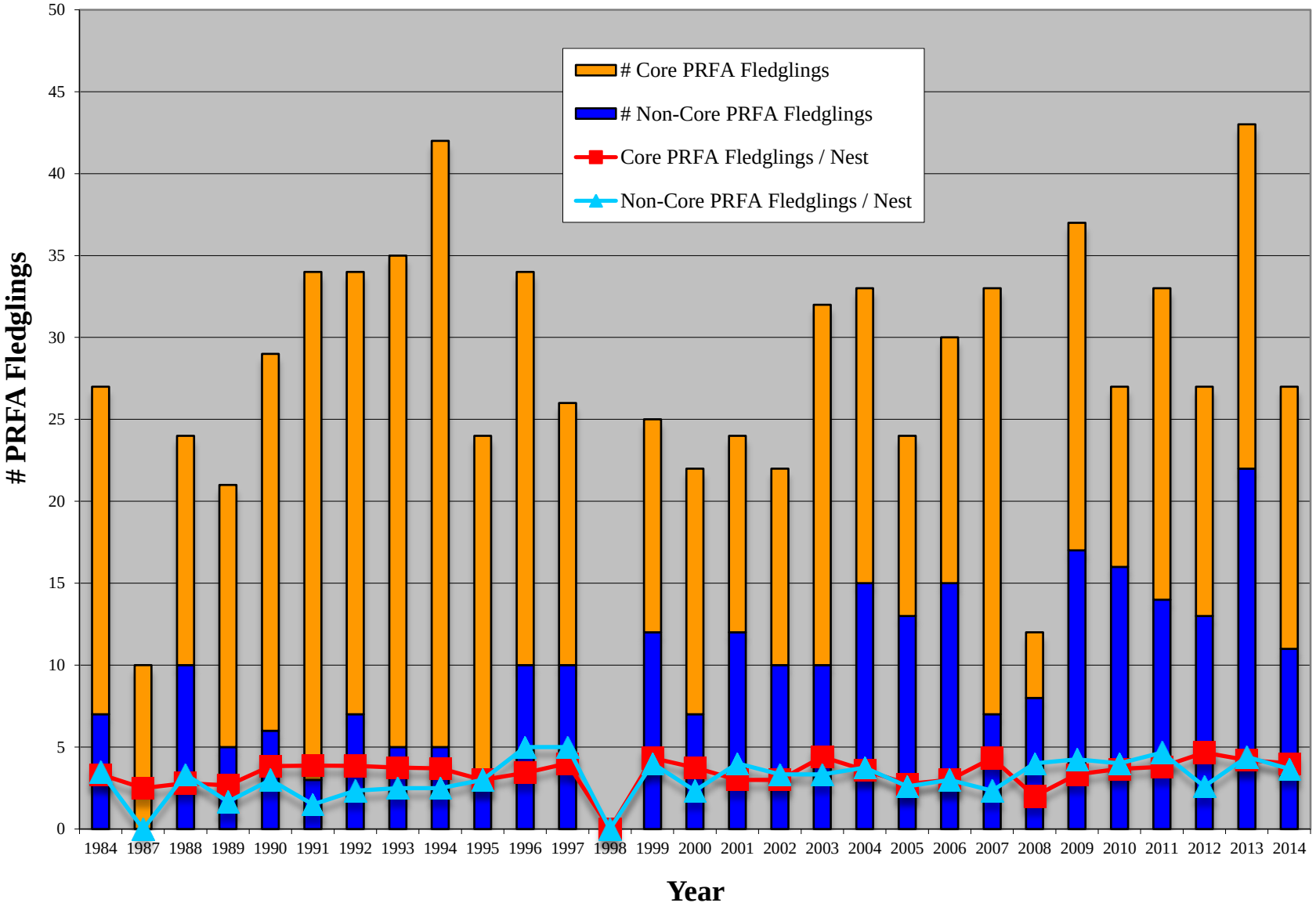

Figure 4. Core vs. non-core Pinnacles prairie falcon fledgling productivity, 1984–2014.

Core Areas: Of the 6 territorial falcon pairs in the core areas in 2014, four nested successfully, producing 16 total fledglings and 4.0 fledglings per nest (Table 4). Productivity numbers are comparable to the 1984–2013 averages of 5.1 successful nests per season, 17.9 total fledglings, and 3.4 fledglings per nest.

Table 4. 1984–2014 Pinnacles prairie falcon nesting productivity – core areas only.

Year	Territorial Pairs	Nesting Pairs	Successful Nests	# Nestlings	# Nestlings / Nest	# Fledglings	# Fledglings / Nest
1984	7	6	6	22	3.7	20	3.3
1987	5	4	4	13	3.3	10	2.5
1988	8	6	5	14	2.8	14	2.8
1989	8	8	6	16	2.7	16	2.7
1990	9	7	6	23	3.8	23	3.8
1991	9	8	8	31	3.9	31	3.9
1992	9	7	7	29	4.1	27	3.9
1993	10	9	8	34	4.3	30	3.8
1994	10	10	10	38	3.8	37	3.7
1995	10	9	7	21	3.0	21	3.0
1996	9	8	7	28	4.0	24	3.4
1997	8	6	4	16	4.0	16	4.0
1998	7	5	0	0	0	0	0
1999	6	5	3	13	4.3	13	4.3
2000	5	5	4	15	3.8	15	3.8
2001	7	6	4	12	3.0	12	3.0
2002	5	5	4	12	3.0	12	3.0
2003	5	5	5	22	4.4	22	4.4
2004	7	7	5	21	4.2	18	3.6
2005	6	5	4	12	3.0	11	2.8
2006	7	6	5	17	3.4	15	3.0
2007	6	6	6	26	4.3	26	4.3
2008	7	3	2	4	2.0	4	2.0
2009	7	7	6	24	4.0	20	3.3
2010	8	6	3	11	3.7	11	3.7
2011	8	7	5	19	3.8	19	3.8
2012	7	6	3	14	4.7	14	4.7
2013	6	6	5	25	5.0	21	4.2
2014	6	4	4	16	4.0	16	4.0
Averages (1984–2013)	7.3	6.4	5.1	19.0	3.6	17.9	3.4

Non-Core Areas: Of the 6 territorial falcon pairs in the non-core areas in 2014, three nested successfully, producing 14 total fledglings and 4.7 fledglings per nest (Table 5). These numbers are higher than the 1984–2014 average of 2.8 successful nests per season, 9.7 total fledglings and 3.1 fledglings per nest.

Table 5. 1984–2014 Pinnacles prairie falcon nesting productivity – non-core areas only.

Year	Territorial Pairs	Nesting Pairs	Successful Nests	# Nestlings	# Nestlings / Nest	# Fledglings	# Fledglings / Nest
1984	3	3	2	8	4.0	7	3.5
1987	1	0	0	0	0	0	0
1988	4	3	3	10	3.3	10	3.3
1989	4	4	3	8	2.7	5	1.7
1990	5	3	2	8	4.0	6	3.0
1991	5	3	2	3	1.5	3	1.5
1992	4	4	3	9	3.0	7	2.3
1993	3	3	2	5	2.5	5	2.5
1994	3	3	2	7	3.5	5	2.5
1995	3	2	1	3	3.0	3	3.0
1996	3	2	2	7	3.5	10	5.0
1997	4	2	2	10	5.0	10	5.0
1998	3	2	0	0	0	0	0
1999	4	3	3	12	4.0	12	4.0
2000	3	3	3	7	2.3	7	2.3
2001	3	4	3	12	4.0	12	4.0
2002	6	4	3	14	4.7	10	3.3
2003	7	4	3	11	3.7	10	3.3
2004	5	4	4	15	3.8	15	3.8
2005	7	5	5	17	3.4	13	2.6
2006	8	8	5	18	3.6	15	3.0
2007	8	6	3	9	3.0	7	2.3
2008	5	2	2	8	4.0	8	4.0
2009	5	4	4	17	4.3	17	4.3
2010	5	5	4	16	4.0	16	4.0
2011	5	5	3	14	4.7	14	4.7
2012	5	5	5	14	2.8	13	2.6
2013	6	5	5	22	4.4	22	4.4
2014	6	6	3	14	4.7	11	3.7
Averages (1984–2013)	4.6	3.6	2.8	9.7	3.3	9.4	3.1

Phenology

The first prairie falcon pairs were observed at Egg (a named rock formation) and Resurrection Wall on 1 January 2014 (Appendix A). Incubation was first observed at Egg and Resurrection Wall on 30 March. The first hatching occurred between 22–24 April at the Resurrection Wall nest. The first fledging took place from 1–4 June at the Resurrection Wall nest. The last fledging took place at Drywall on 25–28 June.

Other Notes

All 10 eyries chosen by prairie falcons were used in previous years. All prairie falcon eyries were within historically documented territories. Three nesting attempts failed this year. Four territories occupied by prairie falcon pairs in the past five years – D. Soto Canyon, Pipsqueak Pinnacles, Narrows, and Marion Canyon – were vacant this year.

Discussion

Ten prairie falcon pairs attempted to nest this year and 7 successful nests produced 27 nestlings and fledglings, compared to 28-year averages of 10.0 nesting pairs, 7.9 successful nests, 29.1 nestlings, and 27.3 fledglings (Table 2). In core areas, numbers for total successful nests, nestlings, and fledglings were comparable with and slightly lower than average in 2014 (Table 4). In non-core areas, respective numbers were also comparable with and slightly lower than average in 2014 (Table 5). Three nest failures were documented at non-core area nest sites, one during incubation, one likely just after hatching of young (given observations of attempted prey deliveries after nest failure), and one during development of nestlings. Three nestlings at the North Chalone nest site failed to fledge. Given remoteness of the nest sites, moderate temperatures during the periods of nest failure, and suspected or confirmed nestlings at North Chalone Peak and NE Section 15, predation was suspected for all nest failures. However, given the lack of confirmed observations (e.g. of predated eggs or nestlings) and constant monitoring at the sites (e.g., through remote video surveillance), other causes of nest failure cannot be entirely ruled out.

Prairie falcon productivity numbers for the 2014 season were comparable with the 28-year averages of the Pinnacles raptor monitoring program.

Conclusions, Management Implications and Recommendations

Climbing management actions, outreach, and recommendations for further management and research are listed below. Refer to Appendix D for further information on public interest highlights for the 2014 season.

Prairie Falcons: Climbing Advisories

Climbing advisories were put in place in January in areas with historic climber usage to protect nesting raptors from disturbance. In March and April, advisories were updated and lifted in territories that were confirmed unoccupied by prairie and peregrine falcon pairs. Signs detailing climbing advisories were posted at Little Pinnacles, Balconies, Hawkins, Scout Peak, Crowley Towers, Egg, Tunnel, Teapot Dome, and Goat Rock / Resurrection Wall territories.

Due to the large size and climber popularity of Machete Ridge, a partial advisory was instituted at this territory. A partial advisory was also instituted at Balconies after a prairie falcon nest site was confirmed at South Balconies and a peregrine falcon nest site was confirmed at General Balconies. Machete Ridge and North Balconies were opened to climber use after the Balconies falcon pairs had shifted to focus territorial and nesting efforts at the General and South Balconies nest sites.

All regular advisory signs were affixed to metal brackets and cement foundations to prevent theft. The General Balconies advisory sign was vandalized and replaced in 2014. No additional signs were disturbed or stolen.

In 2014, two incidents of off-trail hikers in advisory areas were documented. No incidents involving climbers were documented. No territorial defense behavior by prairie falcons was observed during the off-trail hiker incidents.

Human / Falcon Interactions and Nest Failures

Falcon adults in the North Chalone Peak, Drywall, Willow Spring Slide, Hawkins, and Balconies territories responded to the presence of on-trail hikers and raptor biologists with agitated behavior by circling and wailing above their respective territories.

Prairie falcon nest entries were conducted at the North Chalone Peak, South Balconies, Willow Spring Slide, and Drywall nests by the NPS raptor biologist, with additional assistance from the Resource Management intern (A. Schmidt), condor program crew members and biologists, and volunteers (see Public Interest Highlights below for further details). The North Chalone Peak nest site had failed prior to the nest entry attempt and was therefore not sampled. All nestlings at the South Balconies, Willow Spring Slide, and Drywall eyries fledged successfully.

Prairie falcon nest failures were documented at the Pig Canyon, North Chalone Peak, and NE Section 15 territories. The Pig Canyon nest failed during egg incubation. The North Chalone Peak nest failed when nestlings at the site were 3–4 weeks old. The NE Section 15 nest likely failed after nestlings hatched based on observations of the adult pair still bringing prey items to the nest site after nest failure. Given remoteness of the nest sites, moderate temperatures during the periods of nest failure,

and suspected or confirmed nestlings at North Chalone Peak and NE Section 15, predation was suspected for all nest failures. However, given the lack of confirmed observations (e.g. of predated eggs or nestlings) and constant monitoring at the sites (e.g., through remote video surveillance), nest failures due to human disturbance, abandonment, or other causes cannot be entirely ruled out.

Education Opportunities

Throughout the year, the raptor biologist and park staff participated in public outreach opportunities to inform visitors about raptor conservation. Educational opportunities included participation in formal events (e.g., Rockpile Rendezvous on April 19–20, Climber Appreciation Days on October 24–26, and scheduled PowerPoint presentations for visitors and staff at the East Side Search and Rescue Cache) and informal events (e.g., visitor contact in high-use areas such as High Peaks, Balconies Cliff Trail, and the Bear Gulch Reservoir).

Management Recommendations

- Continue to establish climbing/hiking advisories in core areas (high visitor-use areas) each breeding season to protect cliff-nesting raptor species from human disturbance.

- Increase information opportunities for visitor use assistants and park rangers to educate park visitors about advisories. Prior to the 2004 season, park rangers and interpreters made more attempts to speak with climbers and hikers at trailheads and to regularly rove on trails to provide interpretation and enforcement of resources. Renewing this strategy of interfacing with visitors at trailheads and on trails would help to preserve compliance with climbing advisories as annual visitation increases at the park.

- Enforce advisories with law enforcement rangers. Although advisories are voluntary, disturbing wildlife is a citable offense that law enforcement rangers should continue to employ to discourage visitors from willfully threatening nesting efforts of breeding raptors at Pinnacles.

- Increase use of staff and visitors to observe raptor activity in the field. This can be achieved through regular communication with NPS staff and visitors, continued use of monthly monitoring updates on raptor status at the park, and reminders about filling out wildlife observation cards.

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Appendix A. 2014 nest phenology and success for prairie and peregrine falcons.

Nest Species	Territory Occupied	Nest Code	Arrival Date	Begin Incub	Hatch Date	Fledge Date	Abandon Date	Failed Date	# of Eggs	# of Nestlings	Known Fledglings	Possible Fledglings	Occup. Status
PRFA	Ball Pinnacle	*EGG-1	<1/1										Occupied
PRFA	Cyn N of Willow Spgs	*WSS-2	<1/9										Occupied
PRFA	Central High Peaks												Not Occ.
PRFA	Citadel		<1/7										Occupied
PRFA	Crowley Drainage												Not Occ.
PRFA	Crowley Towers	CT-1	<1/14	<4/4	5/1–5	6/13–16				5	5	5	5
PRFA	D. Soto Canyon												Not Occ.
PRFA	Deserted Valley												Not Occ.
PRFA	Discovery Wall												Not Occ.
PRFA	Drywall	DRY-15	<1/3	<4/12	5/13–17	6/25–28			4	4	4	4	4
PRFA	Egg	EGG-1	<1/1	<3/30	4/26–28	6/4–6			5	5	5	5	5
PRFA	Frog Canyon		<1/10										Occupied
PRFA	Frog / Hand												Not Occ.
PRFA	General Balconies												Not Occ.
PRFA	Goat Rock	*RW-2	<1/1										Occupied
PRFA	Guard Rock												Not Occ.
PRFA	Hanging Valley	*LP	<1/10										Occupied
PRFA	Hawkins												Not Occ.
PRFA	High Pks W of CPA												Not Occ.
PRFA	Little Pinnacles	*HV	<1/10										Occupied
PRFA	Machete												Not Occ.
PRFA	Marion Canyon												Not Occ.
PRFA	Mating Rocks												Not Occ.
PRFA	Narrows												Not Occ.
PRFA	NE Sec 15	NES-4	<1/10	<4/5			5/19–20						Failed
PRFA	Neglected Valley												Not Occ.
PRFA	North Balconies												Not Occ.

Appendix A. 2014 nest phenology and success for prairie and peregrine falcons (continued).

Nest Species	Territory Occupied	Nest Code	Arrival Date	Begin Incub	Hatch Date	Fledge Date	Abandon Date	Failed Date	# of Eggs	# of Nestlings	Known Fledglings	Possible Fledglings	Occup. Status
PRFA	North Chalone	NC-1	<1/10	<4/5	4/23–29			5/9–21	3	3	0	0	Failed
PRFA	North Wilderness Rock												Not Occ.
PRFA	Pig Canyon	PIG-11	<1/9	<4/11				4/12–26					Failed
PRFA	Pipsqueak Pinnacles												Not Occ.
PRFA	Prescribed Burn Cliffs	*RW-2	<1/10										Occupied
PRFA	Resurrection Wall	RW-2	<1/1	<3/30	4/22–24	6/1–4			4	2	2	2	2
PRFA	Scout Peak												Not Occ.
PRFA	South Balconies	SGB-15	<1/24	<4/4	5/1–3	6/12–14				4	4	4	4
PRFA	South Chalone	SC-7	<3/5	<4/5	4/30–5/4	6/11–13				3	3	3	3
PRFA	S. Wilderness Rock												Not Occ.
PRFA	Teapot Dome	*EGG-1	<1/1										Occupied
PRFA	Tugboat												Not Occ.
PRFA	Tunnel	*EGG-1	<1/1										Occupied
PRFA	Upper Bear Gulch												Not Occ.
PRFA	Upper Condor Gulch												Not Occ.
PRFA	Western Front												Not Occ.
PRFA	Willow Spring Slide	WSS-2	<1/9	<4/10	5/7–10	6/18–20			4	4	4	4	4
PEFA	Hawkins Peak	HP-5	<1/1	<4/11				4/12–26					Failed
PEFA	Hawkins Peak	HP-1	<1/1	<5/16	6/20–22	8/1–3			1	1	1	1	1
PEFA	Central High Peaks	*HP-1	<1/1										Occupied
PEFA	South Balconies	SGB-5	<1/1	<4/24	5/14–17	6/17–20			2	2	2	2	2
PEFA	Machete	*SGB-5	<1/1										Occupied
PEFA	North Balconies	*SGB-5	<1/1										Occupied

Note: for the “Occup. Status” column, # refers to possible fledglings, “Occupied” = territorial occupation, “Not Occ.” = no occupation, “Failed” = failed nest, “Abandon” = territory abandoned after confirmed occupancy, “Unknown” = breeding confirmed (see nest code) or likely, but nest status unknown. For the “Nest Code” column, * refers to territorial links for raptor pairs occupying more than 1 territory

Appendix B. 2014 results and discussion for peregrine falcon occupancy and productivity.

Results: Peregrine Falcons

Two peregrine falcon pairs occupied territories at Pinnacles in 2014 and successfully nested at Hawkins Peak and General Balconies (Table APP B.1). This marked the tenth consecutive year that a peregrine falcon pair has nested at Pinnacles, and the first year of the 29-year monitoring program that two peregrine falcon pairs have successfully nested and produced fledglings at the park. Prior to 2004, peregrine falcon occupancy or nesting had not been confirmed at Pinnacles for 48 years. The Hawkins peregrine falcon pair produced 1 fledgling from a second-clutch nest attempt (after an initial nest failure) and the General Balconies pair fledged 2 young (Figure APP B.1), compared to ten-year averages (since 2004) of 0.9 nesting pairs, 0.8 successful nests, 2.4 nestlings, and 2.3 fledglings (Table APP B.2).

Occupied Territories

Core Areas: In 2014 there were two territorial peregrine falcon pairs within the core areas. This number is higher than the average number of territorial falcon pairs (1.0) in the core areas over the last ten years.

Non-Core Areas: In 2014 there were no territorial peregrine falcon pairs within the non-core areas. This number is consistent with the lack of peregrine falcon presence or occupancy in the non-core areas over the last 28 years.

Figure APP B.1. Peregrine falcon fledgling at Hawkins Peak. Photo by Gavin Emmons, 2012.

Phenology and Productivity

The peregrine falcon pairs at Hawkins Peak and General Balconies were first observed this year on 1 January 2014 (Appendix A), but were also documented occupying and defending the respective territories throughout the fall and winter of 2013. Incubation was first observed for the first-clutch attempt by the Hawkins peregrine falcon pair on 11 April. Hatching of young occurred at the South Balconies nest on 14–17 May and at the second-clutch Hawkins nest on 20–22 June. Fledging took place at the South Balconies nest on 17–20 June and at the second-clutch Hawkins nest on 1–3 August.

Table APP B.1. 2014 Pinnacles peregrine falcon breeding summary.

Territory	Nest Used/ Last Year Used	# Eggs Laid	# Young Hatched	# Young Known/ Fledged
Hawkins Peak *	HP-5/ 2010			0/0
Hawkins Peak *	HP-1/ 2013	1	1	1/1
South Balconies *	SGB-5/ 1989	2	2	2/2

*nests within the core area.

Table APP B.2. 1984–2014 Pinnacles peregrine falcon nesting productivity—core areas only.

Year	Territorial Pairs	Nesting Pairs	Successful Nests	# Nestlings	# Nestlings / Nest	# Fledglings	# Fledglings / Nest
1984	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0
2004	1	0	0	0	0	0	0
2005	1	1	1	3	3	3	3
2006	1	1	1	3	3	3	3
2007	1	1	1	3	3	3	3
2008	1	1	1	3	3	3	3
2009	1	1	1	3	3	3	3
2010	1	1	1	1	1	1	1
2011	1	1	0	0	0	0	0
2012	1	1	1	4	4	4	4
2013	2	1	1	4	4	3	3
2014	2	2	2	3	1.5	3	1.5
Averages (2004–2013)	1.0	0.9	0.8	2.4	2.4	2.3	2.3

Discussion: Combined Prairie and Peregrine Falcon Occupancy and Productivity

Given the small sample size and brief period of years that peregrine falcon pairs have occupied and produced young at a breeding territory at Pinnacles, we cannot currently assign any statistical relevance or trend analyses specifically to peregrine falcon breeding results at the park. However, we have combined prairie and peregrine falcon results over the 29 years of monitoring efforts (Table APP B.3 and Figure APP B.2) to represent overall large falcon occupancy and productivity numbers at Pinnacles.

Combined large falcon occupancy and productivity in core and non-core areas this year were higher than the 28-year running average rates. Twelve falcon pairs attempted to nest this year and 9 successful nests produced 33 nestlings and 30 fledglings, compared to 28-year averages of 10.3 nesting pairs, 8.2 successful nests, 30.0 nestlings, and 28.1 fledglings (Table APP B.3).

In comparing prairie falcon results (Table 2 and Figure 4) with combined prairie and peregrine falcon results (Table APP B.3 and Figure APP B.2), peregrine falcon breeding efforts appear to be supplementing overall large falcon productivity to yield more stable numbers over the 29 years of falcon monitoring at Pinnacles. A prairie falcon pair consistently nested at Hawkins Peak before a peregrine pair began occupying the territory 10 years ago; since 2004 no prairie falcons have nested at Hawkins Peak. This may suggest that – in certain instances – prairie and peregrine falcons compete for territorial occupancy of limited cliff-nest habitat at Pinnacles, with total large falcon productivity unaffected but lower total productivity for prairie falcons in the future, particularly if additional peregrine falcon pairs re-occupy more historical territories. However, in 2014 prairie and peregrine falcon pairs in relatively close proximity—at South and General Balconies and at Hawkins and Egg respectively—all successfully nested and fledged young. The prairie and peregrine falcon pairs at Balconies, and respectively at Egg and Hawkins, defended the cliff areas and limited confrontations between the falcon pairs were observed. At present, limited peregrine nesting efforts and data are inconclusive in regard to competition for cliff-nest habitat between the two species.

Table APP B.3. 1984–2014 Pinnacles prairie and peregrine falcon nesting productivity – core and non-core areas combined.

Year	Territorial Pairs	Nesting Pairs	Successful Nests	# Nestlings	# Nestlings / Nest	# Fledglings	# Fledglings / Nest
1984	10	9	8	30	3.8	27	3.4
1987	6	4	4	13	3.3	10	2.5
1988	12	9	8	24	3.0	24	3.0
1989	12	12	9	24	2.7	21	2.3
1990	14	10	8	31	3.9	29	3.6
1991	14	11	10	34	3.4	34	3.4
1992	13	11	10	38	3.8	34	3.4
1993	13	12	10	39	3.9	35	3.5
1994	13	13	12	45	3.8	42	3.5
1995	13	11	8	24	3.0	24	3.0
1996	12	10	9	35	3. 9	34	3.8
1997	12	8	6	26	4.3	26	4.3
1998	10	7	0	0	0	0	0
1999	10	8	6	25	4.2	25	4.2
2000	8	8	7	22	3.1	22	3.1
2001	10	10	7	24	3.4	24	3.4
2002	11	9	7	26	3.7	22	3.1
2003	12	9	8	33	4.1	32	4.0
2004	13	11	9	36	4.0	33	3.7
2005	14	11	10	32	3.2	27	2.7
2006	16	15	11	38	3.5	33	3.0
2007	15	13	10	38	3.8	36	3.6
2008	13	6	5	15	3.0	15	3.0
2009	13	12	11	44	4.0	40	3.6
2010	14	12	8	28	3.5	28	3.5
2011	14	13	8	33	4.1	33	4.1
2012	13	12	9	32	3.6	31	3.4
2013	14	12	11	51	4.6	46	4.2
2014	14	12	9	33	3.7	30	3.3
Averages (1984–2013)	12.3	10.3	8.2	30.0	3.5	28.1	3.3

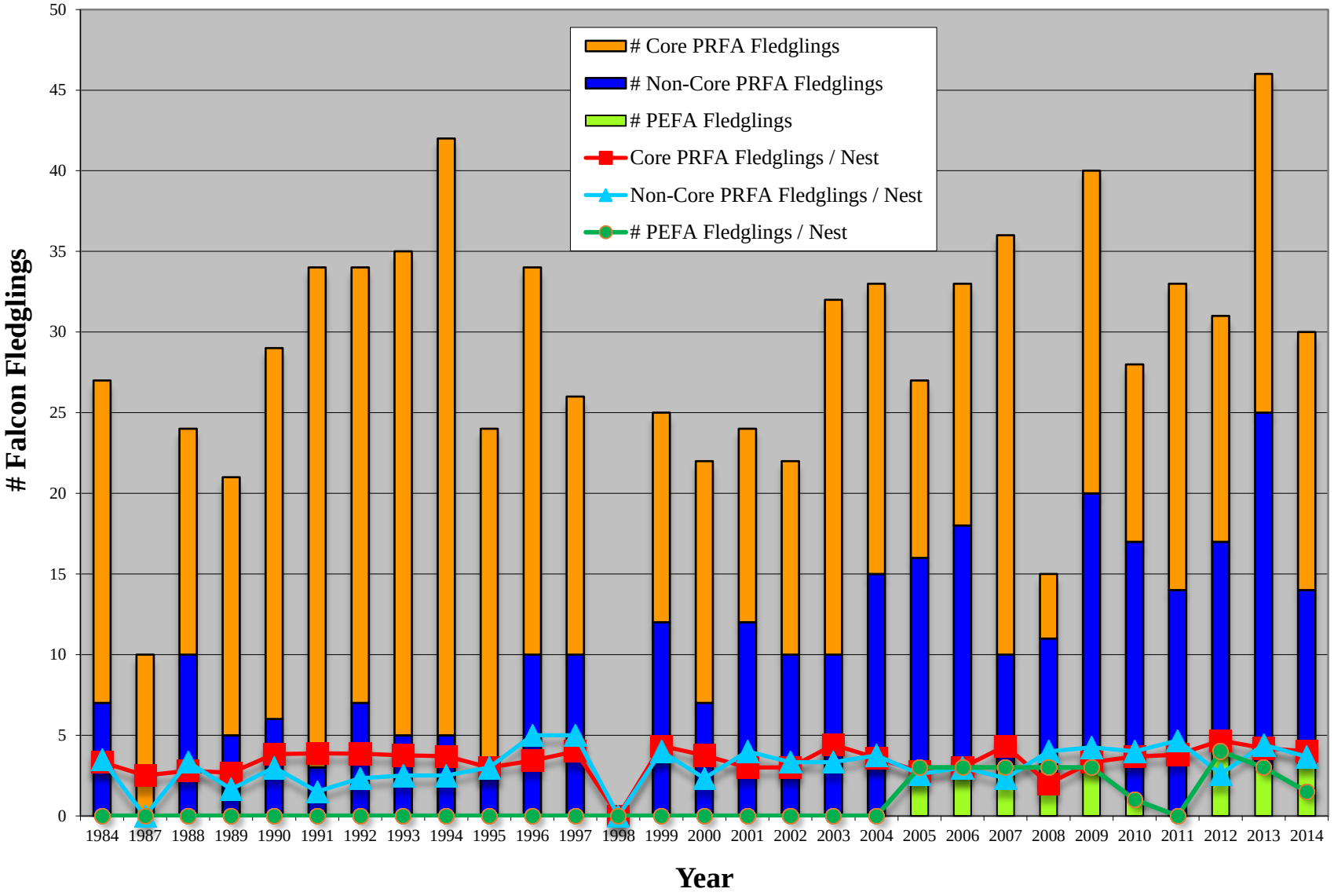

Figure APP B.2. Combined core and non-core Pinnacles PRFA and PEFA fledgling productivity, 1984–2014.

Appendix C. Documentation of changes in data collection methods.

No changes were made to data collection methods for the Pinnacles raptor monitoring program through the course of the 2014 season. Following the end of the 2014 field season, the Raptor Monitoring Access database was updated from .mdb to .accdb format. Terminology and data entry fields in the Data Entry Form were updated to more clearly reflect raptor observations pertaining to the I&M Protocol versus all other observations, to distinguish more efficiently between occupancy and fecundity results, and to provide easier access to territory tables. Data summary tools were also added as queries to allow for more comprehensive review and revision of breeding summary and raptor observation information in spreadsheet format. Legacy data were revised to account for negative data (i.e., no birds observed) for all prairie and peregrine falcon territories surveyed data for the years of 2006–2014. Legacy data for 2003–2005 will be revised to account for negative data for falcon observations in 2015.

In 2010, several changes were made to procedures for entering observations into raptor monitoring databases, and relevant sections in the Raptor Monitoring Protocol were revised accordingly. Primarily these changes were put in place to address inventory and monitoring standards for data management and storage, and the development of a more efficient workflow and structuring of existing MS Access databases. These changes were detailed in the 2010 annual report and are briefly reviewed below.

Through the 2010 season raptor observations and breeding summaries were entered into the "Breeding Raptors" Access database, after development was finalized in 2007–2008. To increase efficient statistical analysis of prairie falcon occupancy and productivity, additional fields were created in the database "Data Entry" form, including fields detailing detection purpose, survey intention, confirmation of territorial behavior, and prairie falcon detection. The SFAN I&M staff is currently completing raptor database revisions to include end-of-season breeding summary queries for number of territories occupied, territorial pairs, nesting pairs, successful nests, total nestlings, nestlings per nest, possible fledglings, and fledglings per nest. The revised raptor database will be used for data collection and management in upcoming seasons.

The 2011 Prairie Falcon Monitoring Protocol was peer reviewed via a blind review process through the task agreement with the University of Washington (UW). Dr. James Agee of UW and Dr. Penelope Latham, Pacific West Region I&M program manager, coordinated and evaluated responses to all peer review comments, successfully completing a five-year process of protocol design and revisions.

Appendix D. Public interest highlights.

The 2014 breeding season was the 29th year of raptor monitoring at Pinnacles. Field observations began 1 January 2014 and ended 1 August 2014, with a total of over 150 possible and active nest sites monitored during 678 observation hours. Climbing advisories were put into effect in January to reduce nest disturbance by visitors, updated to reflect unoccupied territories in March, and lifted in late July at the end of the raptor breeding season.

- During the 2014 season, the NPS raptor biologist independently conducted prairie falcon nest entries at four Pinnacles prairie falcon eyries after gaining Bird Banding Lab sub-permitee status (in 2013) under the master banding permit of raptor researcher Dr. Doug Bell from East Bay Regional Park District. The first nest entry attempt was made at the North Chalone Peak nest, but the site had failed during nestling rearing, likely due to predation. All falcon nestlings at the South Balconies, Willow Spring Slide, and Drywall nests were briefly handled, banded, and blood samples were obtained. All nestlings from the three eyries fledged successfully. Blood samples taken from all nestlings were screened for rodenticide exposure and all 4 falcon nestlings at the South Balconies nest tested positive for trace amounts of Diphacinone. This represented the first confirmation of rodenticide exposure in the Pinnacles prairie falcon population. Additionally, banding and blood sample information collected in 2009–2014 will be used to ascertain genetic insularity and pair fidelity in the Pinnacles prairie falcon population.

- During the 2014 season, two territorial pairs of peregrine falcons successfully fledged a total of 3 young at Pinnacles, representing the first time more than one pair of peregrine falcons has successfully nested at the park during the history of the raptor monitoring program. Prior to 2004, the last previously confirmed peregrine falcon territorial occupancy or nest effort at Pinnacles was documented in 1957.

- An ArcMap project was updated to visually display GPS and GIS information relating to the raptor monitoring program, including historical nest sites, monitoring watch spots, nest distribution by geologic and habitat layers, and locations of advisory signs posted at Pinnacles.

- PowerPoint presentations focused on raptor monitoring and falcon nesting were given to incoming Pinnacles interpretive staff and volunteers.

- The Second Annual Climber Appreciation Days, organized by James Bouknight (the Pinnacles trails foreman), Larry Arthur (the owner of Mountain Tools and a local climber), and the Pinnacles raptor biologist, was a 3-day event focused on local climbers volunteering to restore and maintain climber access trails at popular climbing formations in Bear Gulch. The raptor biologist also used informal interpretive opportunities to discuss resource management, falcon cliff-nesting, and climbing advisories with the 100+ volunteers.

- The Sixth Annual Rockpile Rendezvous, an event to emphasize climber contributions, history, and management at Pinnacles over the past 60 years, was organized by the raptor biologist and the local climbing community, providing visitors with information on historical resource and recreation management at the park.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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